Lloyd's Register

Rules and Regulations for the Classification of Naval Ships, January 2012

Notice No. 5

Effective Date of Latest Amendments:

See page 1

Issue date: November 2012

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RULES AND REGULATIONS FOR THE CLASSIFICATION OF NAVAL SHIPS, *January 2012*

Notice No. 5

This Notice contains amendments within the following Sections of the *Rules and Regulations for the Classification of Naval Ships, January 2012*. The amendments are effective on the dates shown:

Volume	***Part***	***Chapter***	***Section***	***Effective date***
1	1	3	2	1 January 2013
1	4	2	5	1 January 2013
2	1	2	3, 4, 6	1 January 2013
2	2	1	2, 8	1 January 2013
2	3	2	4	1 January 2013
2	8	2	1	1 January 2013
2	7	1	4, 16	1 January 2013
2	10	1	18	1 January 2013

It will be noted that the amendments also include corrigenda, which are effective from the date of this Notice.

The *Rules and Regulations for the Classification of Naval Ships, January 2012* are to be read in conjunction with this Notice No. 5. The status of the Rules is now:

Rules for Naval Ships	Effective date:	January 2012
Notice No. 1	Effective date:	1 January 2013 & Corrigenda
Notice No. 2	Effective date:	1 January 2013 & Corrigenda
Notice No. 3	Effective date:	1 January 2013
Notice No. 4	Effective date:	1 October 2012 & Corrigenda
Notice No. 5	Effective date:	1 January 2013

Volume 1, Part 1, Chapter 3

Periodical Survey Regulations

Effective date 1 January 2013

Section 2

Annual Surveys – Hull, machinery and optional requirements

2.3 Machinery

2.3.18 For ships fitted with machinery shock arrangements in accordance with Vol 2, Pt 1, Ch 2,4.11, the following is to be carried out to the satisfaction of the Surveyor:

(a) A general examination of shock mounts including their condition, date of manufacture and deflection under static load. Particular attention is to be given to mounts which have been installed since the previous survey and to those on which the mounted machinery has been replaced.

(b) Verification that clearances for shock mount deflection and flexible connections around shock capable equipment have been maintained.

Volume 1, Part 4, Chapter 2

Military Load Specification

Effective date 1 January 2013

Section 5

Underwater explosion (shock)

5.3 Notation assessment methodology

5.3.3 For ships where the machinery is in class (**LMC** notation), if the Naval Authority has identified shock requirements for machinery and equipment, the requirements of Vol 2, Pt 1, Ch 2,4.11 ~~should~~ are also to be complied with.

5.6 Seat design

5.6.7 Stress and strain are to be assessed against criteria appropriate for the seat material and loading rate. The first fundamental mode of vibration of the seat including equipment is to be greater than 10 times the shock mount rated natural frequency to provide a sufficiently rigid base for the shock mount. In the absence of specific information, for steel, ~~a stress factor $f\sigma$ = 1,3 can be used for high acceleration shock loads and $f\sigma$ = 1,0 for other shock loads.~~ the following data may be used:

	Tension	Bending	Shear
Plastic deformation of seats	1,3 σ_{ps}	1,3 σ_{ps}	1,0 σ_{ps}
Long loading times ≥0,5 ms (elastic deformation only)	1,0 σ_{ps}	1,0 σ_{ps}	0,8 σ_{ps}
Short loading times <0,5 ms (elastic deformation only)	1,2 σ_{ps}	1,5 σ_{ps}	0,9 σ_{ps}

where

σ_{ps} = static 0,1% proof stress

The values in this Table are applicable to mild and high tensile steel grades up to a yield strength of 400MPa.

Volume 2, Part 1, Chapter 2

Requirements for Design, Construction, Installation and Sea Trials of Engineering Systems

Effective date 1 January 2013

Section 3
Particulars to be submitted

3.3 Calculations and specifications

3.3.11 **~~Shock~~ Machinery shock resistance arrangements**. Where the Naval Authority has defined shock capability requirements for machinery, engineering systems and equipment, ~~a design statement together with plans and particulars are to be submitted for information. *See* 4.11 for shock resistance guidance.~~ the requirements of 4.11 apply and the following details are to be submitted:

(a) The shock policy for the ship. This shall include the shock environment to be used for shock calculations, this will remain confidential to LR.

(b) A design statement that details the shock capability levels for installed machinery, engineering systems and equipment. This statement is to detail how the shock policy has been applied and is to include how the specified shock levels have been accommodated within the design.

(c) List of shock captive equipment identifying name, system/function, location, intended shock qualification and mounting arrangements.

(d) List of shock capable equipment identifying name, system/function, location, intended shock qualification and mounting arrangements.

(e) System plans required by other Sections of the Rules are to identify the location of equipment.

(f) Evidence of shock testing.

(g) Shock mount approval documentation.

(h) In cases where numerical modelling and analysis have been carried out, the following supporting information should be submitted as applicable:

  (i) Reference to a recognised and validated calculation procedure and software used.

  (ii) Evidence of software verification and validation.

  (iii) A description of the modelling.

  (iv) A summary of analysis parameters including properties and boundary conditions.

  (v) Details of the loading conditions and the means of applying loads.

  (vi) Details of acceptance criteria and their derivation.

  (vii) A comprehensive summary of calculation results. Sample calculations should be submitted where appropriate.

  In general, submission of large volumes of input and output data associated with such programs as finite element analysis will not be necessary unless requested by LR. The responsibility for error-free specification and input of program data and the subsequent correct transposition of output rests with the designer.

Section 4
Operating conditions

4.11 ~~Guidance for shock resistance~~ Machinery shock arrangements

4.11.1 Where ~~military~~ shock requirements for machinery, engineering systems and equipment ~~to have shock resistance~~ have been identified by the Naval Authority, ~~the guidance in 4.11.2 to 4.11.27 may be used to assist in achieving the requirements~~ the requirements of this Section are to be met. The Naval Authority is responsible for ~~defining the levels of shock resistance~~ determining if these Rules are adequate to meet their requirements and defining any requirements in addition to the ~~guidance~~ Rules in this Section. ~~The design statement is to include shock capability levels for installed machinery, engineering systems and equipment which should be agreed between the designer and Owner/Operator, see 3.3.11.~~ These Rules may be applied in isolation from or in addition to the requirements of the Shock Enhancement notation, **SH**, *see* Vol 1, Pt 4, Ch 2,5.

4.11.2 ~~Design~~ A shock policy, agreed between the designer, Owner/Operator and the Naval Authority is to be defined for the ship. The policy is to identify the level of shock resistance for installed machinery, engineering systems and equipment ~~should~~ and is to address:

(a) Protection of the crew and embarked personnel.

(b) The capability of machinery, equipment and systems to operate after shock loading.

(c) The capability of securing arrangements to retain machinery and equipment captive after shock loading.

(d) The location of machinery/equipment and routing of essential electrical and piping systems to maintain services in the event of damage due to shock loading.

The application of design and installation of machinery systems for shock resistance is dependent on the Owner/Operator requirements ~~as shock~~ detailed in the shock policy. Shock capability may range from ~~either~~ full operational capability after repeated shock to that for retaining items captive to avoid injury to personnel. ~~*See* 4.11.1 for design statement requirements.~~

4.11.3 The actual threat level used in the calculation of performance of the equipment is to be specified by the Owner and will remain confidential to LR.

4.11.4 Where the shock policy requires that shock capability is to be achieved by separating duplicated equipments within a system, with the aim of ensuring that the system remains operational after a shock event; the equipment is to be rugged and designed to operate in a marine environment. The minimum distance between duplicated equipments is to be in accordance with the policy.

4.11.5 The shock performance of individual items of ship’s equipment required to operate after shock loading is to be assessed by conducting representative shock tests. For larger items of equipment, a combination of shock tests and numerical modelling may be used, subject to the agreement of the Naval Authority.

4.11.6 Where equipment shock testing is required, it is to be carried out at a recognised facility in accordance with a procedure acceptable to the Naval Authority. It is to be ensured that the test arrangements represent the magnitude and direction of loads, and that the loading is applied to the equipment in the configuration in which it will be fitted on board, including shock mounts if applicable.

~~*4.11.3*~~ *4.11.7* ~~A statement of how the specified shock levels have been accommodated within the design is to be agreed between the Shipbuilder and Owner/Operator and be included in the information required by 3.3.11. This may be by evidence of shock testing or calculations or a mixture of both, e.g. equipment~~ Equipment previously tested to a particular shock acceleration for another application, may be ~~specified~~ fitted on a vessel with a ~~higher~~ different shock requirement on condition that ~~it is resiliently mounted to attenuate the incoming shock to a level acceptable to the item~~ the environment in which it is fitted is no more severe than that for which it was tested. In this instance, past test results complemented by a mounting calculation for the ~~more onerous condition would be appropriate~~ proposed arrangements are required.

~~*4.11.4* Where military requirements to reduce the risks of shock damage to machinery, engineering systems and equipment have been identified by the Naval Authority, the good design practice guidance in 4.11.5 to 4.11.27 may be used to assist in achieving the requirements. The use of the guidance will not guarantee that an item of equipment will remain undamaged following shock but will provide confidence that most of the common design deficiencies are identified and avoided.~~

4.11.8 Where equipment containing electronic components is required to be shock capable, the electronic components are to be tested in accordance with the requirements of 4.11.6.

4.11.9 Where equipment is to be installed on shock mounts, the mounts are to be of an approved type and meet the requirements of Vol 1, Pt 4, Ch 2,5.7.

~~*4.11.5*~~ *4.11.10* ~~The use of~~ For systems, machinery and equipment which are required to be shock captive or shock capable, non-ductile, brittle, low impact resistance, or high notch sensitivity materials, particularly grey cast iron and cast aluminium ~~should be avoided~~ are not to be used unless their use can be justified and agreed with the Naval Authority. Materials used ~~should~~, where possible, are to be capable of yielding by approximately 10 per cent before fracture. Whenever possible, the use of glass is to be avoided in machinery, engineering systems and equipment. Where ~~substitution~~ this is not possible, toughened glass ~~should~~ is to be used. Where glass is used in tank level gauges, for tanks containing flammable fluids, automatic self-closing valves are to be fitted at the top and bottom of the gauge to prevent the loss of fluid.

~~*4.11.6*~~ *4.11.11* ~~The~~ For systems, machinery and equipment which are required to be shock captive or shock capable, the use of materials that will be exposed to temperatures below their ductile to brittle transition temperature ~~should~~ is to be avoided.

~~*4.11.7*~~ *4.11.12* ~~Stress~~ For systems, machinery and equipment which are required to be shock captive or shock capable, stress concentrations in structural arrangements for machinery and equipment ~~should~~ are to be avoided and, where possible, welds ~~should~~ are to be located away from high stress areas.

~~*4.11.8* Items of equipment should be as light as possible whilst being compatible with the required strength and operational capability requirement.~~

~~*4.11.9*~~ *4.11.13* ~~Overhung~~ For systems, machinery and equipment which are required to be shock capable, overhung and cantilevered components on machinery and equipment ~~should~~ are to be avoided where possible.

~~*4.11.10*~~ *4.11.14* ~~Where possible,~~ For systems, machinery and equipment which are required to be shock capable, direct support of connected items of equipment from two or more separate parts of the ship’s structure, such as decks and bulkheads, ~~should~~ is to be avoided, since differences in response motions at these positions may cause damage. ~~Gussets (or some other load spreading arrangement) should be used to spread loads to large surfaces and main structural members.~~

4.11.15 To minimise relative movement between items of machinery and equipment that require a fixed relationship to each other, wherever possible, they are to be co-located on a common base or frame.

4.11.16 For systems, machinery and equipment which are required to be shock capable, where pipework passes through bulkheads, penetrations of an approved type which have been shock tested are to be used to avoid point loading of the pipes during a shock event. Alternatively, flanged penetrations which are permanently attached to the bulkhead are to be used.

4.11.17 For systems, machinery and equipment which are required to be shock capable, flexible pipework couplings are to be of an approved type which have been shock tested.

4.11.18 Piping runs are to be supported in the region of valves and fittings and supports are to be arranged as close to the elastic centre of the mounting system as possible.

4.11.19 Where required by the Naval Authority, piping containing flammable fluids passing through compartments of high fire risk are to meet the requirements of 4.11.16 to 4.11.18.

4.11.20 Where equipment is required to remain captive, securing arrangements are to be designed to resist the acceleration/deceleration levels which are associated with the location of the equipment within the ship. The shock captivity levels are to be identified in the design statement.

~~*4.11.11*~~ *4.11.21* The arrangement of equipment attachment locations ~~should~~ is to be such that the height of the centre of gravity above the securing plane is small relative to the span of securing bolts; typically, the height of the equipment centre of gravity should be less than one half of the distance between the outermost securing bolts.

~~*4.11.12* To minimise relative movement between items of machinery and equipment that require a fixed relationship to each other, they should preferably be co-located on a common base.~~

4.11.22 For systems, machinery and equipment which are required to be shock captive or shock capable, equipment housing is to be designed to ensure that it is sufficiently strong to withstand the bolt loadings and not allow them to pull through.

~~*4.11.13*~~ *4.11.23* ~~The~~ For systems, machinery and equipment which are required to be shock capable, the design of machinery trips and breakers ~~should~~ is to be such that shock movement cannot trigger them. Also, pivoted parts and link mechanisms, etc., ~~should~~ are to be balanced if possible.

~~*4.11.14*~~ *4.11.24* ~~Adequate~~ For systems, machinery and equipment which are required to be shock capable, adequate clearances ~~should~~ are to be allowed between fixed and moving items, equipment and structure and pipes and structure. General clearances ~~should~~ are to be approximately 100 mm all round.

~~*4.11.15*~~ *4.11.25* ~~All~~ For systems, machinery and equipment which are required to be shock captive or shock capable, all fixing lugs ~~should~~ are to be closed eyes and not slots. Minimum clearance holes ~~should~~ are to be provided for bolts. ~~General guidance;~~ In general, bolts up to 20 mm diameter~~,~~ ~~bolt diameter + 1 mm~~ are to have a clearance of 1 mm on diameter and for bolts larger than 20 mm, ~~bolt diameter + 2 mm~~ a clearance of 2 mm on diameter.

~~*4.11.16*~~ *4.11.26* ~~Bolted~~ For systems, machinery and equipment which are required to be shock captive or shock capable, bolted connections ~~should~~ are to be tightened to their specified torque limits consistent with the allowable stress in the bolt, typically 2/3 of the yield strength. Lock nuts that lock along the thread length ~~should~~ are to be used in preference to lock or star washers.

~~*4.11.17*~~ *4.11.27* All connections to equipment that is resiliently mounted ~~should~~ are to be capable of accommodating the maximum displacements induced by shock. Resilient mounting of equipment onto equipment that is already resiliently mounted ~~should~~ is to be avoided.

~~*4.11.18*~~ *4.11.28* ~~Flexible~~ For systems, machinery and equipment which are required to be shock capable, flexible hoses and bellows ~~should~~ are to have adequate deflection capability in all directions to accommodate relative displacements induced as a result of shock.

~~*4.11.19*~~ *4.11.29* Removable items and racks, etc., ~~should~~ are to be positively secured when *in situ* with no reliance being made on friction grip or push fits.

~~*4.11.20*~~ *4.11.30* Safety equipment (removable escape ladders, fire extinguishers, etc.) is to be secured with quick release arrangements.

~~*4.11.21*~~ *4.11.31* Portable items ~~should~~ are to have secure stowage or attachments such that they do not become free following shock.

~~*4.11.22*~~ *4.11.32* Electrical cables ~~should~~ are to be installed to accommodate relative movement under shock.

~~*4.11.23*~~ *4.11.33* Where electrical system circuit breakers and fuses are rigidly fastened to the structure they ~~should~~ are to be of an approved shockproof design.

~~*4.11.24*~~ *4.11.34* Electrical plug-in components such as printed circuits or relays ~~should~~ are to be positively secured in position. Retention by friction ~~should be avoided~~ is not permitted.

~~*4.11.25* Backlash in machinery and equipment system design should be kept to a minimum.~~

~~*4.11.26* Piping runs should be supported in the region of valves and fittings and pipe connections should preferably be flanged and arranged as close to the elastic centre of the mounting system as possible.~~

~~*4.11.27*~~ *4.11.35* Flexible mounts ~~should~~ are not to be degraded by the use of other rigid connections to equipment such as pipework.

■ *Section 6*
Diesel engines

6.5 Autofrettage

6.5.1 Manufacturers who carry out autofrettage to enhance the fatigue life of components are to be approved by LR.

6.5.2 LR certificates are to be issued provided the attending Surveyors are satisfied that the required process parameters and associated QA processes have been applied.

~~6.5~~ 6.6 Engine type testing

Existing paragraphs 6.5.1 *to* 6.5.5 *have been renumbered* 6.6.1 *to* 6.6.5.

Table 2.6.1 Test pressures *(part only shown)*

NOTES
6. Where components are subjected to autofrettage the test pressure may be omitted.

Volume 2, Part 2, Chapter 1

Diesel Engines

Effective date 1 January 2013

■ *Section 2*

Particulars to be submitted

2.1 Plans and information

(Part only shown)

2.1.1 At least three copies of the following plans are to be submitted for consideration:

- Schematic layouts showing details and arrangements of oil mist detection/monitoring and alarm systems.
- Diesel generator test results that state the engine maximum load steps which satisfy the quality of power supply requirements specified in Pt 10, Ch 1,1.7.
- Planned operating profiles for the vessel at sea and during manoeuvring as agreed with the operators.

■ *Section 8*

Piping systems

8.6 Intake and exhaust systems

8.6.11 Plastic pipes intended for exhaust systems are to be in accordance with a recognised Code or Standard suitable for the intended service conditions.

Volume 2, Part 3, Chapter 2

Shafting Systems

Effective date 1 January 2013

■ *Section 4*

Design and construction

4.16 Sternbushes and sterntube arrangements

4.16.9 Where sternbush bearings are oil lubricated, provision is to be made for cooling the oil by maintaining water in the after peak tank above the level of the sterntube or by other approved means. ~~Means for ascertaining the temperature of the oil in the sterntube are also to be provided.~~

4.16.10 Two temperature sensors or other approved arrangements that can, where practicable, be replaced without dry-docking or divers are to be provided to ascertain the sterntube aft end bearing temperature.

Existing paragraph 4.16.10 *has been renumbered* 4.16.11

Volume 2, Part 7, Chapter 1

Piping Design Requirements

Effective date 1 January 2013

■ *Section 4*

Materials

4.1 Metallic materials

4.1.4 The Manufacturer's materials certificate validated by LR will be accepted for all classes of piping and components in lieu of an LR materials certificate where the maximum design conditions are less than either of the values shown in Table 1.4.1. *See* Ch 1,3.1.3(b) of the Rules for Materials.

■ *Section 16*

Testing

16.1 Hydraulic tests before installation on board

16.1.1 All Class I and II pipes and their associated fittings are to be tested by hydraulic pressure to the Surveyor's satisfaction. Further, all steam, feed, compressed air and fuel oil pipes, together with their fittings, are to be similarly tested where the design pressure is greater than ~~3,5 bar~~ 7,0 bar. The test is to be carried out after completion of manufacture and before installation on board and, where applicable, before insulating and coating.

Volume 2, Part 8, Chapter 2

Other Pressure Vessels

Effective date 1 January 2013

Section 1

General requirements

1.6 Plans

(Part only shown)
1.6.1 Plans of pressure vessels are to be submitted in triplicate for consideration where all the conditions in (a) or (b) are satisfied:

(b) The vessel contains liquefied gases,~~ for fire fighting or flammable liquids,~~ and

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Volume 2, Part 10, Chapter 1

Electrical Engineering

Effective date 1 January 2013

Section 18

Crew and embarked personnel emergency safety systems

18.2 Emergency alarm system

18.2.1 An electrically operated bell or klaxon or air-operated whistle with independent air supply or other equivalent warning system installed in addition to the ship's whistle or siren, for sounding the general emergency alarm signal is to comply with the *International Lifesaving-Saving Appliances (LSA) Code* and with the requirements of this Section, *see also* 1.14 and 1.15.

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Published by Lloyd’s Register
Registered office
71 Fenchurch Street, London, EC3M 4BS
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